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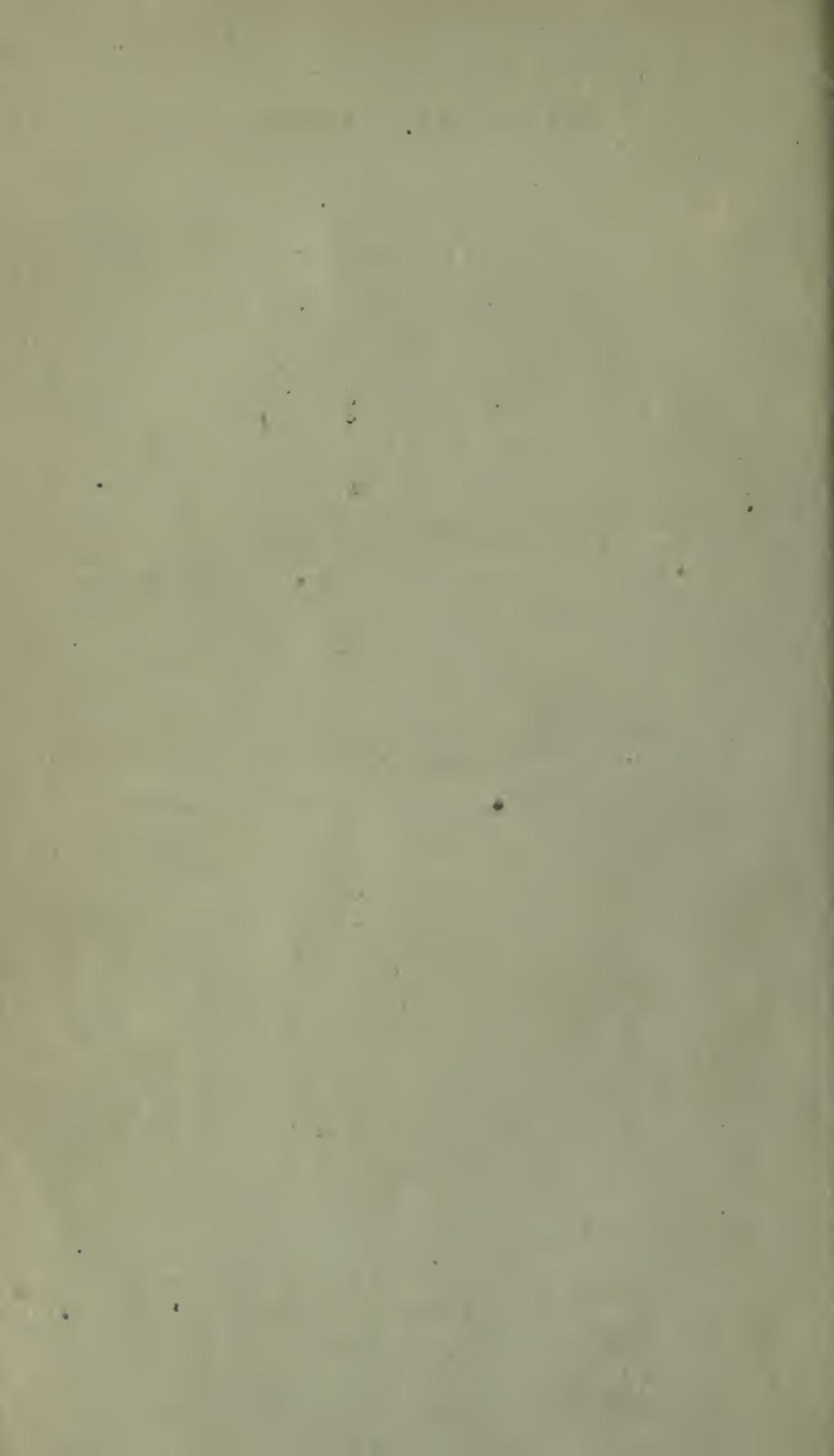
THE STATE HOUSE, DEC. 1, 1857,

BY ORDER OF THE BOARD OF TRUSTEES OF THE SOUTH
CAROLINA COLLEGE.

BY JOHN LECONTE, M. D.,
PROFESSOR OF NATURAL AND MECHANICAL PHILOSOPHY.

COLUMBIA, S. C.:
STEAM-POWER PRESS OF R. W. GIBBES.

1858.



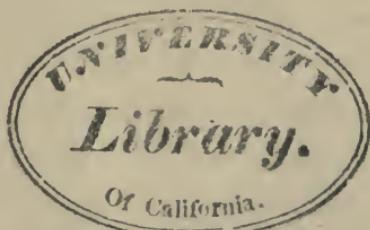
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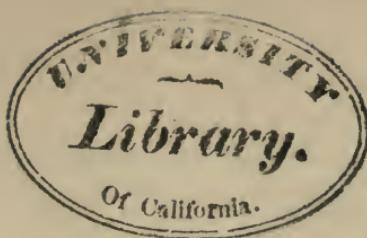
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INAUGURAL ADDRESS.

Edmund Burke, in his admirable Essay on the "Sublime and Beautiful," declares that "It is our *ignorance* of things that causes all our admiration, and chiefly excites our passions." The sentiment thus distinctly and unequivocally enunciated by one of the most elegant and accomplished writers of the last century, seems to have found a very general approving response in the minds of his successors. A deep-rooted conviction appears to have taken possession of the public, that an increasing taste for the cultivation of the exact sciences, necessarily tends to chill the feelings, to dry up the fountains of those nobler enjoyments which spring from the contemplation of nature, and to rob her of the charm and magic of her power. They would have us believe, that in proportion as we learn more and more how to unveil the secrets of nature, in the same proportion do we stifle the vivifying breath of imagination, and obliterate the æsthetic feelings. I think it can be clearly shown, that such a sentiment in relation to the influence of the study of the physical sciences, is without the slightest foundation:—that the opprobrium is as unjust as its reign must be transitory. Such an opinion appears to have had its origin in those narrow-minded views which limit the breadth and depth of physical investigations to the discovery of mere *details*, or to that weak and morbid sentimentality, which

sees in the explosion of antiquated errors, nothing more than a total obliteration of all that is glorious in the realms of fancy. It may be interesting to attempt to trace out the sources of this wide-spread error : for it is obvious that no erroneous sentiment of this kind could have obtained such universality, unless it reflected in some measure the peculiar characteristics of the philosophy of the age. The origin of these fallacious views in relation to the influence of the study of the physical sciences, may be traced to several causes. I shall select from them only a few of the more striking and prominent.

1. One of the most efficient causes of this anti-aesthetic sentiment seems to me to be the general predominance of the *analytical spirit* among the cultivators of science. Nothing exercises a more injurious influence on the development of the imaginative faculties than the prevalence of a system which seems to subject nature to a process of disintegration. It is the province of the imagination to combine and to build—not to tear down and to scatter. During the last century, the influence of this spirit was so overshadowing, that it is by no means astonishing that Burke and his contemporaries mistook a transient phase in the progress of civilization for a permanent condition of scientific development. The temporary ascendancy of the analytical spirit seems to have been a necessary stage in the progress of the human mind towards those higher and more general views, which physical science has bequeathed to our age. Such was the mission of the brilliant galaxy of physical philosophers who flourished during the last century. They developed and elaborated those specialities by means of which we are enabled to

ascend to higher and more comprehensive generalizations, which enrich the intellect, enlarge the sphere of ideas, and nourish and vivify the imagination. Many departments of physical science cannot be thoroughly comprehended without subjecting them to analytical processes, without disintegrating them. But this does not satisfy man's instinctive longing after harmony and connection — symmetry and order. The accurate knowledge of special phenomena thus secured, constitutes a precious heritage to our day and generation. This is the material which must be used in the work of synthesis, and out of which, when combined and co-ordinated, is to be constructed a beautiful and symmetrical Temple of Science. As an edifice cannot produce a striking effect until the scaffolding is removed, which had, of necessity, been used in its erection, so the isolated investigations which have led to general results, must be kept out of view, in order that the imaginative faculties may derive nourishment and strength from the contemplation of Nature. We must distinguish between those great results which form the beacon-lights of Science, and the long series of *means* by which they have been attained. If, in the laborious processes by which these results have been secured to mankind, the wings of fancy seem to have been over-borne by the multiplicity of details, it has been only to plume them for still loftier flights in the domains of imagination.

The unprecedented enlargement of the circle of the Physical Sciences which followed the epochs of Galileo and Newton, rendered a division of labor necessary for the development of knowledge. Thus originated those specialities which have contributed so much to

augment our stock of information in relation to the laws of physics. It may be true, that the undue predominance of the specializing and disintegrating spirit may have, temporarily, tended to repress those general views so favorable to the excitement of the imagination. But such a state must be transitory. It is only a short-sighted and narrow-minded view which looks upon the exercise of those powers by which it is permitted man to comprehend Nature, to lift the veil that shrouds her phenomena, and submit the results of observation to the test of reason and of intellect—as necessarily unfavorable to the development of the æsthetic feelings. The mere accumulation of unconnected details, devoid of generalization of ideas, may have tended to create and foster this deep-rooted prejudice against the Physical Sciences. Those who still continue to cherish such erroneous views in the present age, and amid the advancement of all branches of knowledge, fail in duly appreciating the value of every enlargement of the sphere of mind, and the importance of the detail of isolated facts in conducting us to general results, alike ennobling to the intellect and to the soul of man. It is true that the imagination is not the faculty of mind we evoke to preside over the laborious and elaborate observations by which we strive to attain a knowledge of the greatness and excellence of the universe. The astronomer who, day after day, and year after year, measures patiently the relative distances between two stars composing a binary system, does not feel his imagination more excited than the botanist who examines the fructification of a moss. Indeed, the total absence of all excitement of the imaginative faculties, is the very guarantee of the

precision and trustworthiness of their labors. Yet, the multitude of angular measurements, on the one hand, and the detail of organic relations on the other, alike aid in preparing the way for the attainment of higher views of the laws of the universe.

Those who look upon exact knowledge as exercising a chilling influence on the æsthetic feelings, evidently confound the disposition of mind in the observer at the time he is pursuing his researches, with the ulterior greatness of views resulting from investigation and the exercise of thought. Thus, Mr. Macaulay declares, (*Essay on Milton,*) speaking of the Poet, that “His creed on such subjects will no more influence his poetry, properly so-called, than the notions which a painter may have conceived respecting the lachrymal glands, or the circulation of the blood will affect the tears of his Niobe, or the blushes of his Aurora.” However specious such a view may appear to the mind of the unreflecting, yet it is easy to show its utter fallacy. The painter who is absorbed in anatomical and physiological details, may not experience a glow of imagination during his laborious pupilage; but the exact knowledge of structures and functions which he has thus obtained, will most certainly enable him to portray Nature with greater truthfulness, and to carry his art to increased perfection. The fact that the greatest painters and sculptors have found it necessary to undergo a preliminary training in anatomical studies, is, itself, sufficient to show the utter groundlessness of Macaulay’s opinion. Regarded in a proper point of view, I am bold to say that no one will deny that the painter who has acquired a correct knowledge of the physiology of lachrymation and blushing, *is*,

cæteris paribus, better able to depict “the tears of his Niobe, or the blushes of his Aurora.”

2. A second source of this wide-spread prejudice against the study of the exact sciences, may be found in the general prevalence of *one-sided views and exclusive systems*. To these may be traced the overwhelming supremacy of empiricism, bigotry and dogmatism. Unfortunately, the mass of mankind are liable to be captivated by narrow-minded and exclusive views. Positiveness and dogmatism carry with them the air of truth and sincerity, which sways the popular mind. Thus, by the side of the solid and genuine scientific system, another is seen growing—a system of unproven or mistaken empirical knowledge. Embracing but few particulars, it is the more presuming, because of its utter ignorance of the facts by which it is assailed. Shut up within itself, it is unchanging in its axioms, and arrogant, like everything else that is restricted; whilst enlightened science, enquiring, and therefore doubting, goes on separating the firmly established from the merely probable, and perfects itself daily through the extension and correction of its views. Instead of investigating the *medium point* about which, despite the apparent unfettered aspect of nature, all phenomena oscillate—it only takes cognizance of the *exceptions* to the law—it is ever disposed to presume the train of natural sequence interrupted, and to overlook in the present all analogy with the past. This one-sidedness, and its concomitant arrogance and dogmatism, is as destructive to the true scientific spirit, as it is extinguishing to the noblest aspirations of the soul. Science *does not* claim it as her legitimate offspring. She is not responsible for the charlatanism and

superficial half-knowledge, so characteristic of the present day. The prevalence of such a system opposes everything like those comprehensive views which exalt our conceptions of the dignity and grandeur of Nature, by the discovery of universal laws. The more deeply we penetrate into the mysteries of Nature, the more harmony do we detect : the more do we perceive the connection of phenomena which, severally and superficially regarded, seemed long to resist all attempts at co-ordination and arrangement. We must approach truth from *many sides* in order to comprehend it in that totality and completeness which the true spirit of science demands, and which imparts a living perennial vitality alike to the intellect and to the imagination.

3. Another source of this erroneous view in regard to the study of the physical sciences, may be traced to the *feeling of insecurity* which arises in the ill-instructed multitude, whenever old and deep-rooted errors are exploded by the increase of knowledge. It seems to be a condition of our race, that in the advance towards truth, the mind must fly from one extreme to another. When the former ideas of the physical universe are broken up, there is a period of insecurity and license, which throws back a people or whole nations, into a depth of error and darkness, from which it may require centuries to disentangle themselves. The half-educated pretender gladly embraces the opportunity to promulgate his narrow-minded views : doubt, scepticism and infidelity, with regard to all intellectual questions, take the place of security, faith, and mental repose. Hence arises that strange dread, possessed by so many, of the results of science ; a dread which threatens to destroy that world,

which their faith and feeling for the beautiful had created. They are thus consigned to a state of vacuity and nothingness which would indeed be lamentable and fearful, were it unavoidable. The triumphant conquests of physical science which give us the purest pleasure, are, for such unhappy beings, no less than the dangerous approaches of a conquering foe. It is obvious, that the discord and insecurity which usually pervade the public mind during such a conflict of old and new ideas, exercises a most prejudicial influence on the æsthetic faculties. But its effects on science are equally disastrous ; for under such circumstances, it is impossible to rise to those universal and ennobling views which are the never-failing fountains of true science. Is physics to bear the blame of such ruinous results ? Assuredly not —for history shows that it is through the instrumentality of a more accurate knowledge of physical science, that the insecurity and discord are dispelled, and the connection and harmony restored, without which nothing can be achieved which is exalted or noble in the realms of intellect or of fancy. The source of the evil must be sought in the ignorance of the true principles of science, in the extreme superficiality of those who lead the multitude, and in the weakness of man's faith in the eternal and indestructible nature of the empire of truth. No *lurking mistrust* can find a place in the bosom of the genuine man of science. He who *knows* that all kinds of truth are intimately connected, and that all the best hopes and encouragements which are vouchsafed to our nature must be consistent with truth, will be satisfied and confirmed, rather than surprised and disturbed, to find the boundaries of knowledge enlarged. In the

firmness of that unshaken faith which the contemplation of the order and harmony of Nature inspires, he regards every discovery as a stepping-stone by which man is conducted to higher and more ennobling views, and thereby approaches the eternal source of law, and of intellectual and moral beauty. In short, is it not manifest, that in exchanging vagueness for certainty, the imagination derives nourishment and vigor from the power it acquires of portraying the features of Nature with vivid truthfulness? It is *ignorance*, that, with dazzled eyes, just emerging from the darkness of benighted exclusiveness, perceives that she has been dreaming, without being able to distinguish, in the sunshine, the beautiful lineaments of the great realities which science has exposed to her gaze. "It would, indeed," says another, "be an unworthy homage to the truths which we profess to venerate, to suppose that adoration can be paid to them only while we are *ignorant* of their nature; and that to approach their altars would be to discover, that the majestic forms, which seem animated at a distance, are only lifeless idols, as insensible as the incense which we have offered to them."

Having pointed out a few of the sources of the prejudice which prevails in relation to the influence of the study of the physical sciences, I shall now endeavor to show how the truths which are obtained by observation and reflection, contain rich materials for the imagination. It should be premised, however, that the discoveries of science can only produce their full effects on the æsthetic feelings of mankind, when the knowledge of them becomes so generally diffused as to be

universally appreciated by the intelligent multitude. We must become as intimately acquainted with them as we have been with the legends of the past. To attain this end, it is not, however, obligatory on every one to become a proficient in the study of the details of science, any more than that the customary education hitherto given, pre-supposes a thorough acquaintance with the legendary world. It is the *general* appreciation of comprehensive views which vivifies the imagination and ennobles our enjoyment of the picture of Nature. The knowledge must belong not only to the understanding, but must constitute the very essence of our feelings. The most ignorant, as participators of a common heritage, have unconsciously gained a knowledge of Nature very different from that which was coincident with the childhood of the human race. Truths diffuse themselves gradually and almost insensibly:—at first admired and adopted by a few who are familiar with the condition of science, and are prepared to appreciate the enlargement of view—from them communicated to a large circle, who receive them without discussion; and at length, in this widening progress, becoming so universal as almost to seem the result of *instinct*: like the light of the sun, which we readily ascribe to that luminary, as it flows directly from it, and forces its image on our sight; but which, when reflected from object to object constituting that diffused illumination which enlivens and beautifies our apartments—“soon ceases to remind us of its origin, and seems almost to be a part of the very atmosphere which we breathe.” It would seem as if the great physical discoveries do not nourish and vivify the imaginative faculties, until they become so

familiar to us, that we contemplate them without being reminded of their origin ; until they become, as it were, a part of ourselves. The feeling of gratitude for the source of any individual truth, must be swallowed up in the higher and more general feeling of veneration for the perception of that harmony and unity which fills the soul with admiration. We are thus prone to overlook the influence which science silently, and almost insensibly, exercises on the development of the powers of the imagination. No mind is exempt from the influence of the great physical discoveries of the last three centuries ; no one perceives it at any particular moment, though all are at every moment subject to it. To contemplate often the great truths brought under the comprehension of man, is thus almost to dwell in a sort of social communion with the everlasting source of truth. The influence of the general diffusion of knowledge may—to borrow an illustration from Seneca—in this respect, be compared to that of light, which it is impossible to approach, without deriving from it some faint coloring, even though we should not sit in the very sunshine; or to that of precious odors, amid which we cannot long remain, without bearing away with us some portion of the fragrance. (Seneca, Ep. 108.)

The physical philosopher who measures with admirable sagacity the waves of light of unequal length, which, by concurrence or interference, mutually strengthen or destroy each other ; or who, by the comparison of a long series of observations, is able to trace a periodicity in the secular variation of the magnetic needle, which corresponds with the variation in the spots on the sun ; or who, by means of a revolving mirror, proves that the velocity

of the light which emanates from a candle, is identical with that which reaches us by reflection from the satellites of Jupiter, or with that which beams upon us from stars which are immeasurably distant, surely cannot fail to experience an impression more imposing and more worthy of the majesty of creation, than those who are unaccustomed to investigate the great mutual relations of phenomena. Is it not evident that the natural, the legitimate tendencies of such studies, are to enlarge our sympathies, exalt our conceptions, elevate the soul, and ennable our enjoyment ; by enabling us to attain a vivid appreciation of that endless unity and connection which binds all nature in one eternal chain of causation ? And must not the imaginative faculties flourish and fructify under such vivifying influences ? How immeasurably have the bounds of space and time been enlarged since the elder Herschel “ broke through the enclosures of heaven,”* and, like another Columbus, penetrated into an unknown ocean, from which he beheld coasts and groups of islands, whose position and outlines must be determined by future ages ! Every one is familiar with the feeling of sublimity which takes possession of the imagination, when we contemplate the boundlessness of the ocean ; but how *vastly more* boundless, fathomless and sublime, is that universal *ethereal ocean* which modern science has revealed to us, whose waves are the bearers of messages from world to world, and from system to system ! How illimitable is the empire of universal attraction, as manifested to us in the motions of double stars ! The true student of Nature, whose imagination is stored with such ideas, must be car-

* “ Cœlorum perrupit claustra,” is the elegant inscription on Sir Wm. Herschel’s monument at Upton.

ried upwards, penetrated and animated by the presence of that Divine effulgence, which shines on his soul with the same light from Heaven as that which reaches his eye from the remotest nebula.

In accordance with these views, it is easy to show, that every important step which has been made in the domains of science, has contributed largely to enrich and vivify the æsthetic faculties. Who does not perceive that many of the most sublime and beautiful passages in the "Paradise Lost," are, as it were, the reflections of those grand views of the universe developed by a full recognition and appreciation of the Copernican system? How distinctly and admirably does the great epic poet describe the rotation of the earth!

"Or she from West her silent course advance,
With inoffensive pace, that spinning sleeps
On her soft axle, while she paces even,
And bears thee soft with the smooth air along."

In like manner, the central position of the sun, and the orbital motion of the planets, form the theme of the most beautiful poetic imagery.

"That from his lordly eye keep distance due,
Dispenses light from far; they, as they move
Their starry dance in numbers that compute
Days, months and years, towards his all-cheering lamp
Turn swift their various motions."

The frequent allusions to the telescopic discoveries of Galileo, in the same poem, show how deeply penetrated was the mind of its immortal author, with the true bearing of the great scientific achievements of the Seventeenth Century. For we must not forget, that the epoch of Milton, was likewise the age of Kepler, Galileo and

Bacon, of Tycho Brahe, Descartes and Huyghens, of Fermat, Newton, and Leibnitz.

Let me illustrate this view by another striking example. The establishment of the *progressive motion of light*, by Olaus Roemer in 1675—scarcely more than a year after the death of John Milton—opened new views of the universe. The singular historical state into which creation was thrown by this discovery, was well calculated to produce a powerful impression on the imagination. We accordingly find this idea vivifying the poetic aspirations of the succeeding century. Thus, the author of the “Pleasures of Imagination” speaks of the starry sphere :

“And fields of radiance, whose unfading light
Has travell'd the profound six thousand years,
Nor yet arrives in sight of mortal things.”

In the same manner, the general recognition of the Newtonian system of universal mutual attraction found a hearty response in the poetical inspirations of the Eighteenth Century. The writings of Pope afford numerous illustrations of the fertility of this step in developing the imaginative faculties.

“And, if each system in gradation roll
Alike essential to th' amazing whole,
The least confusion but in one, not all
That system only, but the whole must fall.”

Also, Akenside, speaking of the influence of the sun,

“Beholds his unrelenting sway
Bend the reluctant planets to absolve
The fated rounds of Time.”

These examples are sufficient to show, that the great accession made to the general mass of scientific know-

ledge during the Seventeenth and Eighteenth Centuries, *did not* tend to repress the development of the imagination but rather, to impart greater comprehensiveness and elevation to the poetic inspirations of that age. It would be easy to show, that the discoveries of modern times have exercised a similar genial influence on the imaginative productions of our day. I shall cite but one example. In Lord Byron's sublime apostrophe to the ocean, there is a peculiar truthfulness and charm derived from the recognition of the comparative *stability* of the ocean as contrasted with the *instability* of the solid parts of the earth. And yet, this idea has only derived life and reality from the scientific investigations of the present century.

It is, therefore, a great error, to suppose, as has been done, that the imaginative faculties must necessarily be extinguished within the atmosphere of our scientific halls. On the contrary, I do not hesitate to say, that the painter or the poet, is a better painter or a better poet from being also well versed in science; and to him the vapour-veiled mountain, and golden-tinted cloud, and ocean-worn cliff, will become invested with fresh beauty and fresh wonder, when he has made himself acquainted with those physical laws which fling the mist over the mountain, and drench the evening cloud in gorgeous colors, and have heaved up that granite mass, a barrier to the advancing billow, and a shelter to the sea-bird in its clefts. Who does not admire the surpassingly sublime and pathetic apostrophe to Light, which opens the Third Book of the great English epic poem! And yet, who does not *feel*, that the exalted genius of its immortal author could have invested it with a *higher*

sublimity and a *deeper* pathos, had he been acquainted with the great discoveries of modern science! with the fact, that the luminous vibrations which reach us from the smallest faintly glimmering telescopic stars of a resolvable nebula, come to us like the voices of the past, leading us back through myriads of centuries into the depths of antiquity! and with the wonderful connection which exists between sun-light and all the organic and physical processes which take place on the surface of our planet!

And it must not be forgotten, that all the phenomena of the physical world are mutually connected. It is a fact, long attested by the history of science, that in the observation of a phenomenon, which at first sight appears to be wholly isolated, may be concealed the germ of a great discovery, which shall enlarge the boundaries of thought and fertilize the fields of fancy. Great truths, truths of mighty significance in the physical and intellectual condition of our race, may be dormant within a fact apparently insignificant and unpregnant of result. A few examples will be sufficient to illustrate this *universal affinity* of the truths of physical science. Who could have dreamed of the import of the truth which quivered forth in the vibrating muscles of the dead frog's leg as it hung upon the wires in the laboratory of Aloysio Galvani? His contemporaries could never have anticipated that it placed in the hands of his successors a powerful instrument of chemical analysis, and at the same time, a thermoscope and a magnet. Who could have imagined that there dwelt within those quaint old cups of Alexandre Volta, still preserved in the Museum of Como, a Promethean power which now strings the earth

with a nerve-net, and animates a continent with thought and sympathy? Who could have pictured to himself the marvellous growth of the young giant force which James Watt summoned into being, and which no sneer of the scoffer could strangle in its cradle? When Huyghens first observed, in 1678, the phenomenon of the polarization of light in the divided beam produced by a doubly refracting crystal, or when Malus, in 1808, detected a similar modification while observing the light of the setting sun reflected from the windows of the Luxembourg, through a crystal of Iceland spar—who could have foreseen that the illustrious Arago would, by his discovery of *colored polarization*, be led to discern, by means of a small fragment of the same crystal, whether solar light emanates from a *solid* body, or a *gaseous covering*; or whether comets shine by *direct* or *reflected* light? When the contemporaries of Robert Hooke ridiculed his experiments with the “swing-swangs,” they little dreamed that the pendulum would one day enable the physical philosopher to determine the figure and weight of the earth, and even to sound, as it were, its unseen depths and reveal to us, in some measure, the internal constitution of its strata. When the alchemists, centuries ago, observed that one of the salts of silver was blackened by exposure to light, who could have anticipated, that the fleeting images of a camera-obscura would be rendered permanent, or that the sunbeam contained in it a pictorial power far surpassing in truthfulness the most elaborate efforts of human ingenuity?

It thus appears evident that the smallest contribution to knowledge adds something to the enduring structure of scientific truth, which shall ennoble the enjoyment of

future generations. There are times—as for example the 17th century—when a multitude of great geniuses step forward at once, as if by previous concert, and science is filled with great discoveries. A quieter period follows, in which the great ideas of the previous time are explained, arranged and determined. This endeavor at first promotes the organization of the new ideas; the imagination is nourished and animated by the contemplation of the new views of Nature. But at length the definition is carried to such an extent, that it destroys all life, and it would transform science to a soulless petrifaction, did not genius again appear and rekindle the extinguished fire. It seems as if it were the *instinctive dread* of that universal death, which most powerfully stimulates the slumbering energies of the intellect, and which leads us up to those higher views of science which enrich the imaginative faculties. As our corporeal life consists in a perpetual struggle of antagonistic forces; so our mental life maintains its vigor and strength through a similar contest between truth and error. Every doubt, every contradiction to truth, awakens an argument in its defence, places it in a clearer light, and thus prepares the way for a vivid appreciation of those wider generalizations which exalt our conceptions of Deity and re-act on the moral faculties of mankind.

The fear of sacrificing the free enjoyment of nature, under the influence of scientific reasoning, is often associated with the apprehension that the enlargement of the empire of reality, must necessarily contract the domainis in which the creative powers of fancy delight to rove. It seems to me, that such a view is based upon a misconception of the subject. For it is the peculiar attribute

of the progress of knowledge, that as the field acquires additional extension, the horizon by which it is bounded incessantly recedes before the eyes of the enquirer. Each step that we make in the more intimate knowledge of science, leads us to the threshold of new labyrinths. Nature, as it has been defined, and as the word was interpreted by the Greeks and Romans, is “that which is ever growing and ever unfolding itself in new forms.” The domain of reality thus progressively extending through the perfection of knowledge, is perpetually bordered by a half-transparent, vapor-veiled realm of fancy; a fairy-land where imagination revels and lends a definite outline to the ever-unfolding manifestations of ideal creation. Thus it is, that every accession to science enriches the fields of fancy, and animates the imaginative faculties by bringing new mysteries within their sphere, and opening to them higher and more soul-elevating sources of enjoyment.

There is no danger that the domains of imagination will ever be obliterated by the progress of exact knowledge. We shall never succeed in exhausting the immeasurable riches of Nature; and no generation of men will ever have cause to boast of having comprehended the total aggregation of physical phenomena. In science, as in life, every man, strong or weak, carries his burden but a little way, and then gives place to a younger, who seizes the load joyfully, thinking in his pride, that it is for him to bear it to the end of the journey. But after a short space he is also superseded, for the distance of the goal is infinite; and when we have all passed away Nature will still be inexhaustible.

Experimental sciences, based on the observation of the

external world, cannot aspire to completeness ; the nature of things, and the imperfection of our organs of sense, are alike opposed to it. No mortal has been permitted to penetrate all the arcana of the physical universe and comprehend the whole ; but as science advances the insight must become more extensive, and even a partial solution of the problem will always remain the eternal and sublime aim of every investigation of Nature. Vanity or self-complacency may lead some minds to believe that, in their own age, humanity has reached the culminating point of intellectual progress ; but such a view is at variance alike with history and the laws of thought. The internal connection existing among all phenomena, renders it certain, that every discovery in science prepares the way for higher conquests, and forces upon us the conviction, that when thousands and thousands of years have passed, untrodden paths will still be opened to the scientific observer, leading him to an illimitable world of thought. The regret of Alexander cannot be applied to the progress of observation and intelligence ; for there is no quiet resting place, no pause, except in the invariable, eternal, all-comprehensive source of order, and harmony, and beauty.

The finite nature of our faculties and the position we hold in the physical world, combine to render it impossible for man to embrace the whole of Nature in its universality. Physical causes have entirely concealed *three-sevenths* of the surface of our satellite from our observation, and this must always remain so, under existing cosmical arrangements. The zone of a few degrees in breadth on all sides of the border beyond an exact hemisphere, which is brought into view by her *librations*, only

serves to excite an ever-unsatisfied longing to obtain a deeper insight into the physical constitution of this barren, rugged, volcanic and voiceless wilderness. Nearly similar conditions exist in the intellectual world, where, in the domain of deep research into the mysteries and the primeval creative forces of Nature, there are regions similarly turned away from us and apparently unattainable ; of which only a narrow margin has revealed itself, for thousands of years to the human mind ; appearing from time to time, faintly glimmering either in true or delusive light. In the vast majority of cases, however, the principal difficulty in attaining an exact comprehension of the physical universe, lies in the extreme complexity of phenomena and the apparent multiplicity of causes. In these, the gradual progress of physical science will, to some extent, dispel the apparent contradictions, and introduce order, simplicity and harmony, in the place of irregularity, complexity and discord. In this process of development, it is certain that we can only hope to *approximate* towards a more complete knowledge of the physical universe in its totality. Like the asymptote, the human mind is continually verging towards an accurate comprehension of Nature, without the possibility of ever reaching the limit. Thus it is, that the realm of fancy and imagination, which borders the domain of reality, must always remain, and must continue to unfold new wonders with every enlargement of its circumference. The feebly glimmering nebulae which are scattered through the awful depths of space, must always be the field of the imagination ; while the variable and colored stars, must continue to be the regions of graceful fancy. And it is obvious, that every improvement in our

means of observation, can only heighten the enjoyment which the æsthetic faculties derive from such contemplations. No degree of progress of the physical sciences can ever repress the noble aspirations of the soul, or destroy our appreciation of those sympathies which spring from the depths of the human heart. Supposing the mathematical theory of music to be so far perfected as to enable us—if possible—to calculate all the proportions of a symphony of Mozart or Beethoven; will any one seriously maintain, that this exactness of knowledge necessarily prevents the awakening of those inexpressible feelings of delight by which we are borne heavenward on the strains of musical tones? On the contrary, is it not certain that we would thereby be prepared to appreciate and to enjoy a deeper and a richer harmony than any one can now imagine?

The most casual observation is sufficient to convince every reflective mind, that in the present century we feel the necessity of reconciling the worlds of reason and imagination. This reconciliation cannot be effected in a moment; it must be the result of repeated efforts. In this work of establishing harmony between the two great faculties of the soul, the physical sciences are destined to play a very important part. If we bear in mind the fact, that experimental science cannot boast of a venerable antiquity, we shall be astonished at the great intellectual influence which it has already exercised on mankind. There are a variety of circumstances which render it certain, that a taste for physics must continually grow. No department of knowledge affords more opportunities for daily conversation and communication; the objects lie closely around

us, and are attractive from their variety, novelty and utility; they do not so easily involve mankind in quarrels as other subjects of reflection, which sometimes encourage dispute by their uncertainty, and sometimes by the share which is taken in them by human passion. Physical truths soon gain acceptance, from the fact, that misapprehension cannot long endure where the subject under consideration can be represented under its sensible existence; and conceit or self love, by which men are often led to the most obstinate assertions of previously adopted opinions, has not here such strong temptations to resist, where men are not so often conquered by the superior power of another mind, as by the sentence of nature herself. Moreover, our science is readily accessible to the artisan, and from its intellectual character, is well calculated to elevate him and give him a higher cultivation. Thus it is, that every mechanic is unconsciously gathering fragments of science, which distribute many seeds for reflection. In this manner, a more general appreciation of the real nature of scientific research will be gradually diffused among the multitude, and must ultimately lead to the perception of that unity and connection, which harmonize all branches of knowledge, and enrich alike the domains of science and the realms of fancy. The kingdom of truth cannot be at variance with itself: no contradiction is possible in the laws of nature; they are all in the most perfect harmony, and constitute together one all-comprehensive whole. The apparent discord is always the result of human perversity and the imperfection of knowledge; and we may rest assured, that a more profound investigation will disclose the purest harmony and repose, and

lead to higher and more ennobling views of the universe.

The primary difficulty in making the physical knowledge already acquired the common property of all classes of society, is the lamentable fact, that those who have attempted to *popularize science* in our country, have too frequently been superficial pretenders, who possess not the slightest conception of that mutual connection which constitutes the very life-blood of genuine science. In the hands of such men, every noble and soul-elevating aspiration is merged in a cheerless philosophy which clings to the earth, and reduces the mind to a mechanical condition, delighting in the accumulation of *isolated facts*, regardless of the great laws by which these are regulated; and the harmony of all physical phenomena secured. The great mass of mankind, even in an advanced state of intellectual cultivation, cannot be interested in the *details* of the processes by which important results have been reached. But the great *general truths* to which science has led, are within the comprehension of every sound understanding; and these can only be communicated in an intelligible form, by men of clear and vivid conceptions, and enlarged, comprehensive and well-grounded knowledge.

Moreover, that there is no reason for apprehending that the study of the physical sciences deprives the mind of imagination, or the character of its elevation and refinement, is abundantly proved by an appeal to facts. The names of Leonardo da Vinci, the painter, sculptor, architect and physical philosopher, and of John Wolfgang Goethe, the great modern poet, will forever link themselves with the highest philosophy of nature:

whilst the imaginative, enthusiastic, and truth-loving Kepler—the speculative and profound Leibnitz—the systematic Linnæus—the poetical Ørsted—and the comprehensive Humboldt, are brilliant illustrations of how largely the æsthetic faculty may dwell in minds which have made incursions the deepest and the widest into the realms of scientific truth.

Finally, it should not be forgotten, that the *practical applications* to which almost every conquest in the physical world leads, are themselves the fruit of that unity and harmony which animate the whole material universe. But I am far from believing that it needs any plea of mere *utility*—in the too-generally accepted sense of that term, as synonymous with *money value*—to gain for physical studies a cordial reception from every lover of truth, and every well-wisher of the intellectual and moral advancement of our race. All honor to those practical sciences which the stern realities of life have called into existence—but “man does not live by bread alone”—it is not enough to minister to mere physical wants—it is, indeed, necessary that he should be housed, and fed, and clothed, but there are higher elements of his being, the intellectual, the moral, and the religious, which link him with a purer order of existence, which make him the heir of immortality, the aspirant of Heaven. Science is not to be estimated by coin. Truth must not be despised, if we do not find in it a value which can be weighed in the scales of the money-changer. There is another balance in which the labors of the honest-hearted student, who loves truth for its own sake, will yet be tried, and in which they shall not be found wanting. He who feels a real delight in the knowledge he gains,

without regard to the advantages and the honors which it may procure him, is justified in believing that he has entered the threshold of the sanctuary of science, and he will certainly, by continued efforts, penetrate to its sacred depths. It is then he feels how full of thought is all this marvellous world ; it needs not then poetic fables to people for him every glen and fountain, and wood and hill, with its appropriate genius ; for he knows and feels, as none other can, the spiritual which is around him ; and deep in his inmost soul rests forever the unshaken faith, that on lonely mountain-top, or barren shore, in the deep recesses of the silent wood, or on the boundless expanse of the never-tiring ocean, or the world-islands of unfathomable space, there dwells a Power and a Presence, dimly felt, it may be, through the gross medium of sense—but the true philosopher, with hopeful, trustful confidence, awaits the dispersion of the earth-mist, knowing that in God's own time, the twilight of conjecture must yield to the unclouded noontide of knowledge.

